CALIFORNIA DEPARTMENT OF FISH AND GAME
Annual Report for research and monitoring activities authorized
under the 4(d) research limit submitted to NOAA Fisheries for the period
January 1, 2004 to December 31, 2004

1. **Project Title**: Feather River Hatchery Sprin-run Chinook Fish Ladder Investigation

2. **Please provide name, address, phone, and e-mail addresses of Principal Investigator or contact person(s)**:

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3. **Project is within the following Evolutionarily Significant Unit(s):**
Central Valley Spring Chinook, *Oncorhynchus tshawytscha,*
Central Valley Steelhead, *Oncorhynchus mykiss*

4. **Provide beginning and projected end date, and indicate if study is ongoing:**
April 1 through June 30. This will be an ongoing project for the next 3 years.

5. **Time of year and frequency of sampling (e.g., Jan – Jun; 3 days per week):**
April 1 through June 30, 2-3 times per week. More frequent sampling will occur if the number of fish encountered requires it.

6. Indicate river basin(s) sampled, and approximate latitude and longitude of sampled sites:
Feather River Basin. Sampling will occur at the Feather River Fish Hatchery. N 39^0 31.1115' W 121^0 33.0259'

7. Provide a brief description of the techniques and methods used:
The FRH fish ladder (and associated facilities) will be operated between April 1 and June 30, 2008. All fish that enter the holding tank will be collected and processed twice per week to ensure that fish do not reside in the hatchery for an extended period. All fish will be allowed to enter the FRH continuously until June 30, or until 6000 salmon have entered the hatchery facilities, whichever comes first. *An experimental group of 1200 spring-run salmon will be held under un-crowded conditions in four circular hatchery tanks covered to provide shade and prevent unnecessary disturbance. Each circular tank will hold 300 CVSR. The circular tank is 40 feet in diameter and will be maintained at a depth of four feet, with an average flow of 3-5cfs. The fish will be spawned in early fall as per routine hatchery protocol. After 1200 CVSR are placed in the circular tanks, any additional CVSR which enter the FRH (up to 4800 individuals) will be individually marked with a Hallprint 10 cm plastic tipped dart tag (Hallprint, Victor Harbor, South Australia) below the dorsal fin and immediately returned to the Feather River (as described below).

Steelhead and CVSR will be collected and identified (tagged) by inserting a Hallprint tag below the base of the dorsal fin (steelhead will be tagged with a 4 cm Hallprint tag and internally with a ½ duplex PIT tag-2mm x 22 mm). Each tag has a unique number to provide individual identification. This will prevent collecting tissues from the same fish twice and will provide information on the number of times steelhead and CVSR re-enter the hatchery. As soon as the tag is in place, several small pieces of tissue (approximately 6 mm in diameter) will be punched from the caudal fins of 100 CVSR using CDFG tissue collection protocols. Tissues will be collected from steelhead during initial processing and from Chinook when they are spawned. All tissue samples will be collected by DFG tissue archive personnel. All fish will be examined to document presence/absence of an adipose fin. While the fish is anesthetized, an attempt will also be made to assess sexual maturation by gently rubbing the belly and looking for a discharge of milt or eggs. Immediately after all data has been collected, each steelhead will be placed into a holding tank of fresh water until they recover from the anesthetic enough to be released into the river return channel. The CVSR will be tagged and release to the river. If necessary, the 1200 Chinook to be kept in the FRH will be placed in a circular tank holding area immediately after processing*. The river re-entry point will be inspected before, during and after each sampling event to ensure that all fish released recover as expected. Otoliths will be collected from all dead steelhead and sent to the CDFG tissue archive facility. If a coded wire tag (CWT) is present (CVSR or steelhead), the head will be labeled with a standard CWT head tag and sent to Matt Erickson at the CDFG facility in Healdsburg.

*This will not be needed for 2005, but we would like to keep this option open and review its applicability every year.

8. Estimated Take[1] (#s): If project covers more than one river basin, please itemize take numbers per basin.

Species and ESU	Adult									Juvenile			Comments
	Nonlethal			Lethal						Nonlethal	Lethal		
				Intentional[2]			Unintentional[3]				Intentional[2]	Unintentional[3]	
	M	F	Unk	M	F	Unk	M	F	Unk				M = Male, F = Female, Unk = Unknown
Coho salmon													
So. Oregon/No. Calif. Coasts													
Central California Coast													
Chinook salmon													
Central Valley spring-run			6000						60				
California Coastal													
Steelhead													
Northern California													
Central California Coast													
South-Central Calif. Coast													
California Central Valley			100						2				

1. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."
2. Example: killing steelhead to obtain otoliths or other tissue.
3. Fish that are killed unintentionally from monitoring or research activity. Example: fish killed as a result of electrofishing.

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9. Provide a summary of major findings:

Between May 17 and June 17, 2004, 3650 spring Chinook salmon were marked at the FRH. Twelve salmon were sacrificed for brain tissues (as part of the circadian rhythm research project conducted by Michael Banks, OSU) and an additional 35 salmon were lost prior to marking (1.3% overall mortality during initial handling). Two hundred sixty-five fish were recaptured in the FRH and released again before the marking period concluded on June 17 Two additional fish were found dead in the river possibly due to handling or angling related stress). When spawning commenced in the fall, a total, of 1263 fish were recaptured: 834 at the FRH, 328 in the river escapement survey, and 101 by anglers. The FRH successfully spawned 769 (92%) of the fish returning to the hatchery, but 65 were found dead in holding tanks and were not spawned. One hundred forty-three (87%) of the 165 female salmon recovered in the river escapement survey were classified as spent (and are thus assumed to have spawned successfully).

Eighty nine percent of the marked salmon at the FRH were spawned before October 1. The majority of fish recaptured in the river were found in the upper reaches of the low flow channel (Figure 1 and Figure 2). Based on the escapement survey recapture data the sex ratio of the marked spring-run was 1.33:1 females to males. Of the 101 marked salmon caught by anglers 77% were harvested.

10. If available, provide post-handling mortality results for salmon and steelhead, and briefly describe methods used to measure post-handling mortality.

Preliminary results suggest that this program was successful at individually marking and recapturing spring-run Chinook in the Feather River with very low rates of handling mortality. Providing a mechanism to count the spring-run and visually distinguish them from fall-run at the FRH is vital to restoring and protecting genetic diversity. Future efforts will focus on marking more spring-run and refining the tagging process to increase tag retention and recovery. During and after each marking period the release point for CVSR and steelhead was searched. The day following tagging the river was searched for 8 miles to monitor for tagging mortalities. Only 2 were found during these searches. Due to the high visibility of the Feather River during the summer, it is unlikely that many CVSR mortalities would be missed.

11.Provide a brief description of the measures taken to minimize disturbances to listed salmon and steelhead, and the effectiveness of these measures.

To better understand spring-run Chinook life history in the Feather River the CA DWR and CA DFG set out to count and individually mark all salmon that entered the FRH facilities in the spring. Studies performed in 2003 showed that holding a limited number of salmon over-summer in the Feather River Hatchery (FRH) is possible, but at great expense. Furthermore, the hatchery can not provide the appropriate holding conditions for large numbers of spring Chinook. Thus, an alternative program was developed to mark up to 4000 Chinook salmon entering the hatchery between April 1 and July 15, 2004. Once marked, fish were released and allowed to over-summer naturally in deep pools of the lower Feather River. During the hatchery spawning season, the mark enabled the FRH to spawn early arriving spring-run separately from fall-run Chinook. The marking experiment conducted in 2004 worked exceptionally well. Overall mortality for the entire project was less than 1.5%. Furthermore, new techniques were developed to minimize handling time of CVSR. This will allow us to mark and release CVSR under minimal anesthesia.

12. Describe any problems and/or unforeseen effects (e.g., fish injuries or mortalities) on salmon and steelhead that occurred during the project.

Mortalities were low in the tagged fish. Few (<50) adult fish died due to mechanical problems with the mechanical Crowder. Only 2 mortalities occurred in the river between 1 and 8 weeks after handling.